





KETTLER CAPITALS ICEPLEX

APRIL 15, 2008 MEGAN KOHUT STRUCTURAL OPTION




BUILDING STATISTICS

- Washington Capitals practice facility
- Arlington, VA
- 137,000 SF + 8 level parking garage
- Two regulation sized ice rinks, training facilities, corporate offices
- \$42.7M
- Constructed January 2005 to July 2007




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REINFORCING EXISTING STRUCTURE

- Foundation Expansion
- Column Reinforcing
- Lateral System




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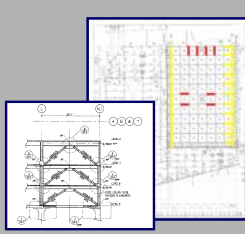


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REINFORCING EXISTING STRUCTURE


- Foundation Expansion
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PROPOSED SOLUTION



- More convenient location
- Help eliminate deflection issues if ice rinks located on SOG


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OVERALL TASKS & GOALS

1. Civil/Site Analysis
 - Entrance/Exit Locations
 - Minimize Impervious Area
2. Architectural Design
 - Utilize Ground Floor Location
 - Consistent Square Footage Program
 - No. Parking Stalls
3. Structural Design of Transfer System
 - Design for Efficiency without Interfering with Architecture
4. Construction Management Assessment
 - Minimize Any Increase in Cost
 - Minimize Construction Time


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CIVIL/SITE ANALYSIS

- **TASKS:**
 - a. Determine the best locations for garage entrances and exits
 - b. Design garage entrance and exit vehicular flow patterns
 - c. Minimize Impervious Area

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TRAFFIC ANALYSIS

- *The Dimensions of Parking:*
 - Entrance – High Volume
 - Exit – Low Volume
- Traffic Data Obtained from Virginia DOT
 - N. Randolph St. vs. N. Glebe Rd.
- Major Intersection
- **CONCLUSION:** One Entrance off Glebe Rd.; One Exit off Randolph St.



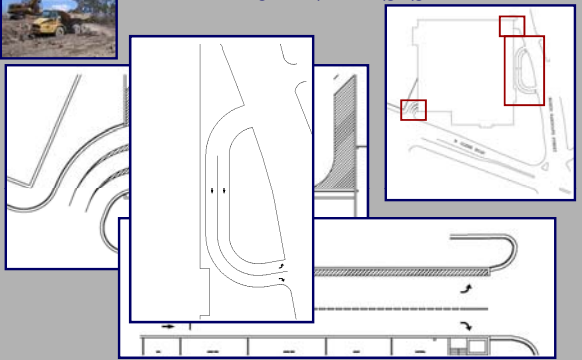


Photo courtesy of Google Earth


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TRAFFIC ANALYSIS

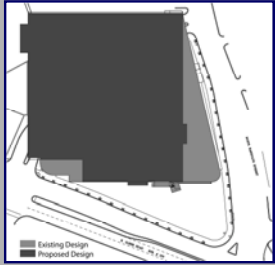


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IMPERVIOUS AREA

- Original Footprint = 168,975 SF
- New Footprint = 147,826 SF
- **14% Reduction in Impervious Area**



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CIVIL/SITE CONCLUSION

1. Civil/Site Analysis
 - Entrance/Exit Locations ★
 - Minimize Impervious Area ★★
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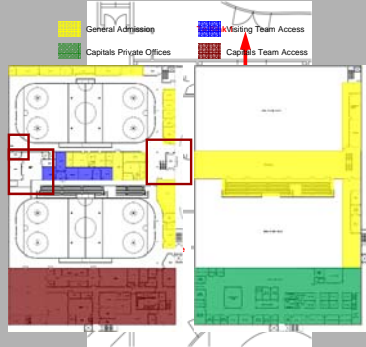
ARCHITECTURAL DESIGN



- **TASKS:**
 - a. Redesign Architectural Layout
 - b. Maintain Current Square Footage Program
 - c. Utilize Ground Floor Entrances
 - d. **DO NOT** Decrease No. of Parking Stalls
 - e. Maximize Vehicular Flow Efficiency in Garage
 - f. Allow Space for Transfer System Structure

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ARCHITECTURAL DESIGN


- Most Key Spaces within 10%
- Main Entrance Utilizes Drop-Off Loop
- Secondary Entrance From Parking Garage
- New Feature: Zamboni Storage

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PARKING LAYOUT






- Original Design = 2800 Stalls
- New Design = 3800 Stalls
- Smart Parking System



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FINAL DESIGN

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ARCHITECTURAL CONCLUSION



1. Civil/Site Analysis
 - Entrance/Exit Locations ★
 - Minimize Impervious Area ★★
2. Architectural Design
 - Utilize Ground Floor Location ★★★
 - Consistent Square Footage Program ★★
 - No. Parking Stalls ★★★★★
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STRUCTURAL DESIGN

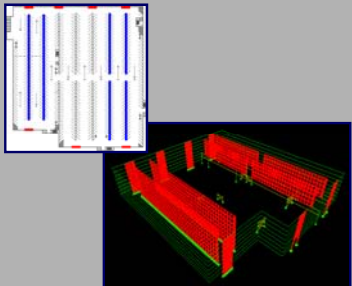


- **TASKS:**
 - a. Design Transfer System to Take Gravity and Lateral Loads from Parking Garage Above
 - b. Limit Any Architecture Interference

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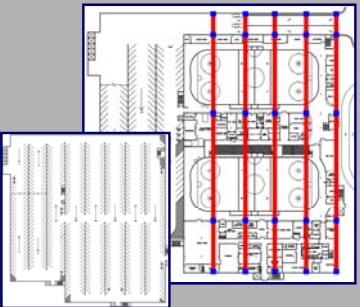
LATERAL FORCE RESISTING SYSTEM

- 7 Shear Walls
- 6 Lite Walls
- Braced Frames




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TRUSS LOCATIONS



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DESIGN ATTEMPT 1



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DESIGN ATTEMPT 1

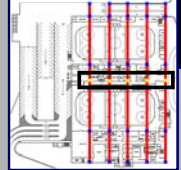
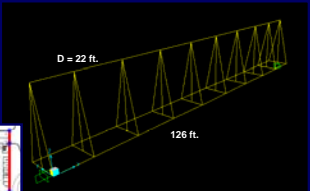
- 169' Top Chord: W36x800 = 238% Stressed!



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DESIGN ATTEMPT 2

- Decrease Span
- Increase Depth
- Space Truss

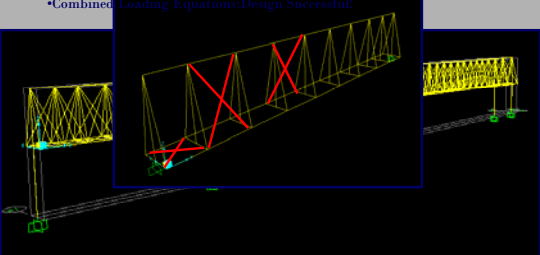


- 126' Top Chord: W36x800 = 118% Stressed!

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DESIGN ATTEMPT 3

- Additional Web Members
- Combined Loading Equations: Design Successful!



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DESIGN ATTEMPT 3

•Gravity Only Design:

TC: W40x503
BC: W36x150
Web Members: HSS3x3x3/8 to HSS12x12x5/8

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DESIGN ATTEMPT 3

•Gravity + Lateral Design:

TC: W36x441
BC: W36x135
Columns: W30x261 to W36x441
Web Members: HSS3x3x3/8 to HSS14x14x5/8

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DESIGN ATTEMPT 4

•Additional Columns

Columns: W30x261 to W36x441
Columns: W30x261 to W30x292

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FINAL DESIGN CONSIDERATIONS

- Deflections
 - DL = 2.33" (L/641)
 - LL = 0.82" (L/1822)
 - Total_{Factored} = 3.61" (L/414)
- Constructability
- Empty Space Can Be Used For Mech. Equip.
- Loss of one level of parking = 341 stalls

5 Levels Parking

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STRUCTURAL CONCLUSION

- Civil/Site Analysis
 - Entrance/Exit Locations ★
 - Minimize Impervious Area ★★
- Architectural Design
 - Utilize Ground Floor Location ★★★
 - Consistent Square Footage Program ★★
 - No. Parking Stalls ★★★★★
- Structural Design or Transfer System
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CONSTRUCTION MANAGEMENT

- TASKS:
 - Develop Cost Estimate for Proposed Design and Compare to Actual Cost
 - Estimate Mall Loss in Revenue
 - Estimate Project Schedule and Compare to Actual Schedule

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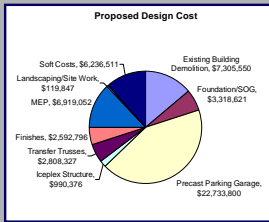
COST COMPARISON



- Original Cost = \$42.7M
- Proposed Design Cost = \$53M

\$53M > \$42.7M

- Estimated Loss of Mall Revenue = \$21.6M



Proposed Design Cost

Category	Amount
Soft Costs	\$6,236,511
Landscaping/Site Work	\$119,847
MEP	\$6,919,052
Finishes	\$2,592,796
Transfer Trusses	\$2,868,327
In-situ Structure	\$990,376
Existing Building Demolition	\$7,305,550
Foundation/SOG	\$3,318,621
Precast Parking Garage	\$22,733,800

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PROJECT SCHEDULE



- Original Schedule = 360 Working Days (495 Days Total)
- Actual Construction Time ≈ 912 Days Total
- Proposed Schedule** = 848 Working Days (1170 Days Total)

**Possibly Over-Estimated: PE estimated this is approximately a 30 month project.

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CONSTRUCTION MANAGEMENT CONCLUSION



1. Civil/Site Analysis
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 - Minimize Impervious Area ★★
2. Architectural Design
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CONCLUSION & RECOMMENDATION



1. Civil/Site Analysis
 - Entrance/Exit Locations ★★
 - Minimize Impervious Area ★★★
2. Architectural Design
 - Utilize Ground Floor Location ★★★
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QUESTIONS ???



A Special Thanks to:







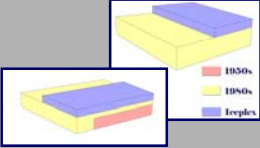



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capitals **EXISTING CONDITIONS**

- Parking Structure
 - 5 story CIP concrete
 - 1 story post-tensioned concrete
 - 2 story composite steel
- Iceplex
 - Two ice rinks, corporate offices, training facilities
 - 2 story composite steel

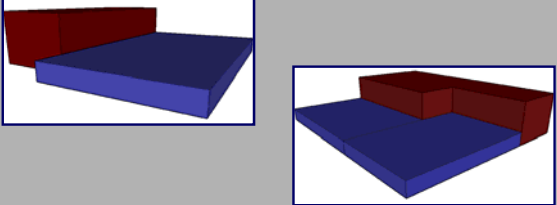


Legend:
1050s (Yellow)
1090s (Blue)
Iceplex (Blue)

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capitals **DESIGN POSSIBILITY**

- Keep Iceplex and Garage as Separate Structures
- Build Garage as Adjacent Tower
- All Site Permitting



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